AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (CURRENTLY AMENDED) A method of multiplexing ionization signals from a plurality of cylinders, comprising the steps of:

calculating an action period, said action period being related to a total number of the plurality of cylinders;

combining said ionization signals, whereby information from said ionization signals is spaced apart by at least an action period in duration; and

outputting said ionization signals, whereby no overlap of information occurs between said ionization signals.

2. (CURRENTLY AMENDED) The method according to claim 1 wherein said action period is calculated by dividing a number of crank degrees for a cylinder to cycle through all strokes by [[a]] said total number of the plurality of cylinders.

3. (ORIGINAL) The method according to claim 1 wherein said step of outputting said ionization signals comprises multiplexing said ionization signals at intervals equal in duration to said action period.

4. (ORIGINAL) The method according to claim 1 wherein said step of combining said ionization signals comprises summing said ionization signals.

5. (ORIGINAL) The method according to claim 1 further comprising the step of multiplexing each of said ionization signals with a driver current feedback signal.

6. (ORIGINAL) The method according to claim 2 wherein said number of crank degrees for a cylinder to cycle through all strokes is 720 degrees and said total number of said plurality of cylinders is five.

7. (CURRENTLY AMENDED) A ~~The~~ method ~~according to claim 5~~ of multiplexing ionization signals from a plurality of cylinders, comprising the steps of:

calculating an action period;

combining said ionization signals, whereby information from said ionization signals is spaced apart by at least an action period in duration;

outputting said ionization signals, whereby no overlap of information occurs between said ionization signals; and

multiplexing each of said ionization signals with a driver current feedback signal;

wherein said step of multiplexing each of said ionization signals with a driver current feedback signal comprises the steps of:

outputting said ionization signal;

enabling a charge command signal, whereby a primary winding of an ignition coil is charged;

outputting a charge current feedback signal while said charge command is enabled;

disabling said charge command signal; and

outputting said ionization signal after said charge command signal is disabled.

8. (CURRENTLY AMENDED) An engine, comprising:

a plurality of cylinders;

a plurality of ignition systems, whereby each of said plurality of ignition systems has an ionization signal output and is operably connected to at least one of said plurality of cylinders;

a summer having a plurality of inputs and an output, wherein at least one of said ionization signal outputs is operably connected to one of said plurality of inputs of said multiplexer; and

a powertrain control module for calculating an action period, said action period being related to a total number of the plurality of cylinders, having at least one input operably connected to said output of said summer.

9. (ORIGINAL) The engine according to claim 8 wherein all of said ionization signal outputs are current sources.

10. (ORIGINAL) The engine according to claim 8 wherein at least one of said plurality of ignition systems is an integrated ignition system.

11. (ORIGINAL) The engine according to claim 8 wherein said powertrain control module comprises:

a controller;

memory operably connected to said controller; and

software stored in said memory.

12. (CURRENTLY AMENDED) An ~~The~~ engine, ~~according to claim 10~~ comprising:

a plurality of cylinders;

a plurality of ignition systems, at least one of said plurality of ignition systems being an integrated ignition system, whereby each of said plurality of ignition systems has an ionization signal output and is operably connected to at least one of said plurality of cylinders;

a summer having a plurality of inputs and an output, wherein at least one of said ionization signal outputs is operably connected to one of said plurality of inputs of said multiplexer; and

a powertrain control module having at least one input operably connected to said output of said summer,

wherein said integrated ignition system comprises:

an ignition coil comprising a primary winding with a first and a second end and a secondary winding with a first and a second end;

a coil driver circuit having a first end operably connected to said second end of said primary winding;

an ionization detection circuit having at least two inputs and an output, wherein a first input is operably connected to said second end of said primary winding, and a second input is operably connected to said first end of said secondary winding; and

a switch having at least two inputs and an output, wherein a first input is operably connected to said output of said ionization detection circuit, a second input is operably connected to a second end of said coil driver circuit, whereby said output of said switch is multiplexed between an ionization signal and a charge current feedback signal.

13. (CURRENTLY AMENDED) The engine according to claim 11 wherein said software comprises:

instructions to calculate [[an]] said action period, whereby no overlap occurs between ionization signals; and

instructions to sample at least one of said ionization signals over said action period.

14. (CURRENTLY AMENDED) The engine according to claim 13, wherein said software further comprises instructions to calculate said action period by dividing a number of crank degrees for a cylinder to cycle through all strokes by [[a]] said total number of said plurality of cylinders.

15. (ORIGINAL) The integrated ignition system according to claim 12 further comprising an amplifier having an input and an output, wherein said input is operably connected to said output of said switch.

16. (ORIGINAL) The engine according to claim 12 wherein all of said ionization signal outputs are current sources.

17. (CURRENTLY AMENDED) An engine, comprising:

a plurality of cylinders;

a plurality of ignition systems, whereby each of said plurality of ignition systems has an ionization signal output and is operably connected to at least one of said plurality of cylinders, and wherein all of said ionization signal outputs are current sources and at least one of said plurality of ignition systems is an integrated ignition system;

a summer having a plurality of inputs and an output, whereby at least one of said ionization signal outputs is operably connected to one of said plurality of inputs of said summer; and

a powertrain control module for calculating an action period, said action period being related to a total number of the plurality of cylinders, having at least one input operably connected to said output of said summer, wherein said powertrain control module comprises

a controller,

memory operably connected to said controller, and

software stored in said memory.

18. (CURRENTLY AMENDED) The engine according to claim 17 wherein said software comprises:

instructions to calculate [[an]] said action period, whereby no overlap occurs between ionization signals; and

instructions to sample a multiplexed ionization signal.

19. (CURRENTLY AMENDED) ~~The~~ An engine, ~~according to claim 17~~ comprising:

a plurality of cylinders;

a plurality of ignition systems, whereby each of said plurality of ignition systems has an ionization signal output and is operably connected to at least one of said plurality of cylinders, and wherein all of said ionization signal outputs are current sources and at least one of said plurality of ignition systems is an integrated ignition system;

a summer having a plurality of inputs and an output, whereby at least one of said ionization signal outputs is operably connected to one of said plurality of inputs of said summer; and

a powertrain control module having at least one input operably connected to said output of said summer, wherein said powertrain control module comprises

a controller,

memory operably connected to said controller, and

software stored in said memory,

wherein said integrated ignition system comprises:

an ignition coil comprising a primary winding with a first and a second end and a secondary winding with a first and a second end;

a coil driver circuit having a first end operably connected to said second end of said primary winding;

an ionization detection circuit having at least two inputs and an output, wherein a first input is operably connected to said second end of said primary winding, and a second input is operably connected to said first end of said secondary winding; and

a switch having at least two inputs and an output, wherein a first input is operably connected to said output of said ionization detection circuit, a second input is operably connected to a

second end of said coil driver circuit, whereby said output of said switch is multiplexed between an ionization signal and a charge current feedback signal.

20. (CURRENTLY AMENDED) The engine according to claim 18, wherein said software further comprises instructions to calculate said action period by dividing a number of crank degrees for a cylinder to cycle through all strokes by [[a]] said total number of said plurality of cylinders.